CEC No. 02-AFC-02

SALTON SEA GEOTHERMAL UNIT 6 POWER PLANT PROJECT

RESPONSES TO:
CALIFORNIA ENERGY COMMISSION
DATA REQUESTS, SET FOUR (NOS. 136 - 147)

Application for Certification (02-AFC-02) for Salton Sea Geothermal Unit 6 Power Plant Project

Submitted by:
CE OBSIDIAN ENERGY LLC

Submitted to:
California Energy Commission
1516 Ninth Street, MS-4
Sacramento, California 95814-5512

File date: February 28, 2003

Table of Contents

Visual Resources

Technical Area: Visual Resources
Author: James Adams
SSU6 Author:

CORRECTED VISUAL RESOURCES DATA REQUESTS 136, 137, AND 139

There was a factual error and a technical lack of clarity in the previously submitted visual resources data requests number 136, 137, and 139. The following data requests are resubmitted showing the corrections in underline/strikeout.

BACKGROUND

Staff has identified the need for the establishment of three new key observation points and additional current and photo-simulations. These will be used to determine if there could be any significant visual impacts on local residents, travelers, or visitors to the Sonny Bono Salton Sea National Wildlife Refuge.

Well over 10,000 people visit the Salton Sea Refuge Complex each year. The project would be visible from the top of Rock Hill and staff needs to consider the amount of the view disruption caused by the project plumes from this public observation area.

REVISED DATA REQUEST

136. Please provide a high-quality 11" by 17" color photo-simulation, at life-size scale, from a location 200 yards east of the SR-~~111~~ 86 point of intersection with the proposed IID interconnection line proceeding to the L-line interconnection. Also provide a current view without the proposed lines at the same size and scale.

Response:

The requested visual simulation and current view will be submitted during the week of March 10th.

137. Please provide a high-quality 11" by 17" color photo-simulation, ~~180 degree panoramic view with the proposed project at center, during average winter~~ to include the proposed project (at life-size scale), Signal Mountain, and predicted water vapor plumes during reasonable worst case meteorological conditions, from the public viewing area at the top of Rock Hill. Also provide a current view at the same size and scale. Please provide the dimensions of the plumes depicted in the simulation.

Response:

The requested visual simulation and current view will be submitted during the week of March 10th.

139. Please provide high-resolution electronic versions (PDF format acceptable) on a CD of ~~all~~ the figures ~~presented in the visual section of the AFC, and the figures~~ prepared in response to these data requests.

Response:

Five compact diskettes of the base photographs and the visual simulations prepared in response to Data Requests #'s 136 and 137 will be submitted during the week of March 10th.

Air Quality

Technical Area: Air Quality
Authors: William Walters
SSU6 Author: Paul Neil

BACKGROUND

Cooling Tower Exhaust Partitioning – Ammonia

The applicant indicates that the H_2S contained in the condensate stream, which is routed to the oxidizer boxes in cooling tower cells "A" and "K", is primarily emitted from only two cells of the cooling tower. Staff needs additional information to determine the amount of ammonia emission partitioning in the cooling tower.

DATA REQUEST

140. Please indicate the expected emission partitioning of ammonia in all of the cooling tower cells.

Response:

The primary source of ammonia released in the cooling tower is steam condensate, which is used for makeup to the tower. The ammonia passes through the oxidizer box and into the cooling tower basin where it mixes with the circulating cooling water. Since the oxidizer box converts hydrogen sulfide to sulfuric acid, the pH of the condensate leaving the box is rather low. This tends to keep the basic ammonia in solution. However, in the cooling tower basin, the acid is neutralized. The ammonia laden cooling water passes through the plant condensers where it is heated and then it is distributed over the cooling tower cells. There it is contacted by a large quantity of air and stripped from the cooling water. This explains why the ammonia is distributed evenly across the tower.

Visual Plume Assessment

Technical Area: Visual Plume Assessment
Authors: William Walters
SSU6 Author: Thomas Priestley

BACKGROUND

Existing Cooling Tower Description

Staff's visual observation of the existing cooling towers in the Salton Sea geothermal area has shown that some of these cooling towers have visual plumes, albeit not large plumes, under ambient conditions where staff would not expect see visual plumes (i.e. relatively high temperature and low relative humidity). Staff needs additional description of the existing cooling towers to determine whether the unexpected plume occurrence is a function of the design of the existing cooling towers, or whether the incorporation of the condensate stream in the cooling tower or other design parameter common to the existing and proposed cooling tower, is the cause for this phenomena.

DATA REQUEST

141. Please describe the design of the existing cooling towers; in particular describe differences between the design of the existing cooling towers and the cooling tower being designed for SSU6.

Response:

As with all of the cooling towers at the Salton Sea, SSU6 will be a counterflow type. The type of fill or internal structure of the cooling towers varies considerably among the Salton Sea units. The SSU6 cooling tower will employ low clog fill, as does Unit 5. Units 1, 2, 3, and Leathers employ high efficiency fill. Unit 4, Hoch, and Elmore employ splash bars, whereas Vulcan has Rotofill.

The SSU6 stack diameter (32 feet) will be comparable to the other units, which range from 28 to 34 feet. The SSU6 stack velocity will be comparable to Elmore and Leathers, but will be significantly higher than each of the other facilities. The SSU6 cooling tower total volumetric airflow, and airflow per cell, is higher than each of the other facilities.

142. Please indicate if the phenomena of plume occurrence during high temperature, low relative humidity conditions may also occur at the SSU6 cooling tower, and please indicate if there is a potential cause for this phenomena, if the specific existing cooling tower designs are not the cause.

Response:

As noted, visible plumes from cooling tower operation(s) can occur under a wide variety of atmospheric conditions, including those meteorological conditions where one would not expect a visible plume to form (i.e., high temperatures and low relative humidity). The simple fact is that cooling towers, through the large water vapor and heat rejection rates, can temporarily overwhelm the atmospheres' ability to evaporate the large amounts of water vapor as it is emitted from the cooling tower.

Soil and Water Resources

Technical Area: Soil and Water Resources
Author: Mike Krolak
SSU6 Author: EJ Koford

BACKGROUND

The Salton Sea Unit 6 (SSU6) Project's average annual water use is expected to total approximately 293 acre-feet per year (AFY). According to Data Adequacy Response WATER-11, the vast majority of this water (290 AFY) will be used for cooling and diluting the brine prior to reinjection. This amount is based on the design geothermal brine salinity of 23.5%. If the salinity of the brine increases, the SSU6 Project will require more water for project operation. Page 5.4-8 of the AFC states that if the brine were to reach a salinity of 25.0%, the project would require approximately 987 AFY, 3.4 times the amount needed at the design salinity. If the salinity of the brine were lower, at 21 percent, then the project would require only 2.3 AFY, less than one percent of the water needed at the design salinity.

Two tables were provided in Data Response 78 that further describe fresh water use for the project. The first table describes the fresh water use for the project at the design salinity of 23.5 percent. At this salinity, the applicant stated that "water consumption for this process would be constant throughout the year," at 180 gallons per minute (gpm). This rate would be constant throughout the year, regardless of ambient temperatures.

The explanation for the second table states "In the unlikely event that the brine salinity is 25 percent, IID water consumption of the plant would vary based on thermal conditions and 987 AFY represents the total annual consumption." The table shows that water use at 25 percent salinity would range anywhere from 180 gpm to 1198 gpm.

These tables indicate that fresh water use will fluctuate according to ambient temperatures when the brine is at 25% salinity, but will not be affected by thermal conditions when the brine is at 23.5% salinity. Staff requires further clarification of this issue to determine how much fresh water will be used by the project and under what circumstances this water will be used.

DATA REQUESTS

143. Please discuss why a 1.5% increase in brine salinity necessitates 3.4 times as much fresh water for the process, and why a 2.5% decrease requires less than one percent of the fresh water demand at design salinity. Please include all calculations, assumptions, and appropriate references.

Response:

The required amount of dilution water is dependent on the amount of brine sent to the power plant and the salinity of the brine. Based on expected conditions of the produced fluid, dilution water would only be required when the brine salinity exceeds about 23.3 percent by weight (wt%). The amount of brine required depends on the enthalpy of the brine. The enthalpy is a function of the salinity and the reservoir temperature of the brine. The minimum fresh water requirement is 182 gallons per minute (gpm or 293 acre-feet/year) for process use for all salinities below 23.3 wt%.

The Applicant evaluated an extreme case, assuming a high salinity case of 25 wt% and a low enthalpy of 395 Btu/lb. For this case, about 525,000 pounds per hour of dilution water is required.

144. Please explain why fresh water consumption fluctuates according to thermal conditions at 25% salinity, but not during other conditions. Please include all calculations, assumptions, and appropriate references.

Response:

As noted in Data Request #143, dilution water is not generally required when the salinity is below 23.3 wt%. Therefore, the fresh water consumption is stable for brine salinity's below that level. Above 23.3%, the required dilution water is provided by plant condensate and augmented by fresh water as needed. As the salinity increases, more fresh water augmentation is required. The amount of fresh water augmentation required would be seasonal since the supply of excess condensate varies with ambient temperature. In the winter, no fresh water augmentation is required, even for the extreme case (see DR 143). In the summer, as much as 1,018 gpm may be needed. Based on the Salton Sea climatology data, the Applicant has determined the monthly average variation in fresh water augmentation and has integrated this over the entire year. The resulting worst-case scenario results in an additional 695 acre-feet/year of fresh water required (total of 987acre-feet/year) over that required by the base case. The reason for this is that the 23.5 wt% salinity case does not fluctuate and that very little dilution water is needed and much of the needed water can be provided from excess condensate. In the 25 wt% extreme case, more dilution water is needed, which can not continuously be provided by excess condensate.

145. Would the fresh water use vary according to thermal conditions if the brine were at a salinity less than 23.5%, such as 21%? At what level(s) of salinity does the variation based on thermal conditions begin?

Response:

The fresh water consumption does not vary according to thermal conditions at salinity's below 23.8%. This is the point at which the variation begins.

BACKGROUND

Data response 75 states that "there would be a few days each summer when the daily maximum temperature exceeds 113 F. In this case, augmentation [from the canal water supply] may be required depending on the operating circumstances of the power plant." This implies that fresh water will be used for cooling under certain operating conditions. However, during the Data Response Workshop on January 8, 2003, the applicant stated that revisions would be made to the water balance diagrams regarding this issue. Staff requires clarification to determine how fresh water will be used by the project.

DATA REQUEST

146. Please provide revisions to the water balance diagrams that confirm whether fresh water will be used for cooling the SSU6 Project. Please provide any associated explanations that clarify the source and volume of fresh water that will be used for the project's needs.

Response:

As noted in Data Request #75, any day with a maximum daily temperature in excess of 113 °F may cause a cooling water deficit even when averaged over 24 hours. This deficit will increase from zero at 113 °F to as much as 1.7 acre-feet/day when the maximum ambient temperature reaches 121 °F (the local record high temperature). A review of 57 months (1/1/96 - 9/30/00) of hourly temperature data taken at Imperial, CA shows that the daily maximum temperature exceeded 113 °F on 26 occasions. This averages 5.47 days per year. Had SSU6 been in operation at full load during this time, the total canal water used to augment the cooling tower makeup would have been 13.8 acre-feet. Thus, the annual average hot day fresh water augmentation would be 2.9 acre-feet/year.

During the 57 month period, there were at most 3 successive days with a daily maximum temperature which exceeded 113 °F. The hottest year during this period was 1998 with 16 hot days. Fresh water consumption during 1998, assuming the SSU6 was in operation at full load, would have been 8.2 acre-feet. In 1999, there were no days where the temperatures exceeded 113 °F days. Therefore, no fresh water would have been required for cooling in 1999.

BACKGROUND

Data Response 80 discusses the City of Westmorland's treated wastewater supply. The Response for Section (i), Part 1 states that the discharge from the City of Westmorland averages 0.37 million gallons per day (MGD).

In October of 2002, the City of Westmorland completed upgrades in their water treatment facility that included increasing the capacity from 0.375 MGD to 0.5 MGD, as well as increasing the treatment facilities to improve effluent quality such as eliminating open-air treatment ponds and adding an effluent disinfection system. Staff requires further clarification for an analysis of alternatives.

DATA REQUEST

147. Did the alternatives analysis provided in Data Response 80 include these upgrades to the Westmorland facility? If not, please provide an analysis of the Westmorland treated effluent incorporating new upgrades for both capacity and effluent quality.

Response:

The alternatives analysis provided in Data Response 80 did not include the upgrades to the Westmorland facility. However, consideration of these upgrades does not substantively change the Applicant's response and/or the potential concerns regarding utilization of treated wastewater in geothermal facilities. With the delicate chemical balance that exists at a geothermal facility and the fact that some of the control equipment used is biological in nature, the use of treated wastewater poses a significant risk to biotreatment technology such as oxidizer boxes when treatment chemicals are added to the process. The use of treated wastewater in geothermal applications has not been adopted in practice.